5 GHz RF Modem User Manual

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Revision History

Rev	Date	Author	Comments
01	16-Aug-2005	M. Smutek / R. Hughes	Preliminary version
02	14-Nov-2005	M. Smutek	Revisions & additional commands
03	17-Jan-2006	M. Smutek / R. Hughes	Additional commands and updates, MIB, licenses, warranty, installation & configuration
04	07-Feb-06	M. Smutek / R. Hughes	Glossary. RF radiation warning. Miscellaneous clarifications and editorial corrections.
05	30-Jan-07	M. Smutek / R. Hughes	Updates including addition of Model 4050R rack mount unit, data sharer, local management user accounts, SNMPv3, configuration defaults, and changes to local management commands.

FCC COMPLIANCE STATEMENT

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's expense.

WARNING
RF EXPOSURE HAZARD

Under certain operational circumstances and when connected to a typical high gain directional antenna, this equipment is capable of producing RF radiation exposure in excess of the limits defined in FCC 47CFR 1.1310, Table 1. Personnel working in the vicinity of an energized antenna should ensure that they maintain a distance of at least 4.2 feet (1.28 meters) from the antenna in the direction of maximum gain. All antenna maintenance activities should be performed only when the associated RF Modem transmit power has been muted.

NOTICE

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To allow for the introduction of design improvements, specifications are subject to change without notice.

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1 Introduction

1.1 System Overview

The Models 4050 and 4050R are 5 GHz full-duplex Radio Frequency (RF) modems with link speeds of 64 and 128 Kbps. Data formats are synchronous serial, asynchronous serial, and 10Base-T Ethernet. The Model 4050R is intended for rack mount applications and includes a two port data sharing feature. The Model 4050 is typically used as an embedded modem or in standalone applications.

1.2 Features

Radio

- 5 GHz operation (5.091 – 5.101 and 5.140 – 5.150 GHz)
- Transmit power: 1W up to 50°C
- Occupied bandwidth: 100 KHz @ 64 Kbps, 200 KHz @ 128 Kbps
- Sensitivity: -98 dBm @ 64 Kbps, -96 dBm @ 128 Kbps
- Dynamic range: 70 dB
- Point-to-point
- Point-to-multipoint (TX keyed by RTS)

Modem

- Link speed: 64 or 128 Kbps (automatically set by data interface)
- Error correction: Reed-Solomon
- Interleave depth: 0 to 6

Data Interfaces

- Serial: synchronous or asynchronous (software selectable)
- Synchronous speeds: 64 or 128 Kbps
- Synchronous clock: internal, external, or looped (software selectable)
- Asynchronous speeds: 300 – 19200 bps
- Interface: EIA-232 and EIA-530 (software selectable)
- DB-25F connector (DCE)
- Two port data sharer (modem 4050R)
- Ethernet 10Base-T (layer 2, protocol independent)

Management

- Local serial port (9600, 8N1)
- DE-9F (DCE)
- Command line interface
- Password protected (three authorization levels)
- Alarm status LEDs (front and rear panels, four each)
- Alarm contact closures (solid-state, four form A)
- Ethernet 10Base-T management port
- DHCP capable
- SNMP V3

2 Installation and Configuration

2.1 General Installation and Operating Considerations

2.1.1 Antenna

Avoid operating the transmitter without a proper termination on the RF connector. Although the modem is designed to withstand such operation, undesired interference to other RF systems may occur.

A typical installation will require the use of a high gain antenna. Proper alignment of the antenna is critical to ensuring an error-free link. During the alignment process, an **`rsl`** command from the Craft Interface Terminal (CIT) will display near real-time receive signal strength and may be used to "peak" the antenna positioning.

This equipment produces RF radiation when connected to a typical high gain directional antenna. Personnel working in the vicinity of an energized antenna should ensure that they maintain a distance of at least 4.2 feet (1.28 meters) from the antenna in the direction of maximum gain. See the caution statement at the beginning of the manual.

The RF Modem is shipped with the transmitter set in the "mute" condition. This is done to prevent inadvertent transmission on an unauthorized frequency. All operating parameters, including an estimate of the minimum necessary transmit power, should be programmed into the modem before un-muting the transmitter.

Do not exceed +10 dBm input power at the antenna terminal of the RF Modem or damage to the unit may result.

2.1.2 Site Planning

As with any wireless link, proper system and path planning is essential to ensuring error-free operation. Such planning should take into consideration path clearances from obstructions, interference from nearby radiators, multi-path reflections and fading. A system signal strength margin of at least 20 dB above the rated receiver threshold is standard practice.

When installing multiple modems in the same general location, ensure that they are all transmitting within the same sub-band to prevent interference and desensitization.

2.1.3 Cooling

Install the RF Modem so that adequate airflow can be maintained through the rear and side or front vents. If airflow is restricted, the modem internal temperature may rise above the preset thermal shutdown temperature.

2.1.4 Shielding and Grounding

When the DB-25F connector is used for the RF Modem EIA-530/232 data I/O, ensure that a good quality shielded cable is used and that the cable shield is electrically terminated to the cable connector shells.

A grounding stud is provided on the rear panel. A ground braid should be attached to this lug and connected to a local earth ground to prevent static charge build-up on the modem, antenna and associated cabling.

2.2 Configuration Procedure

2.2.1 Account & Password Setup

Access to the local management port requires logging in with an account name and corresponding password. As shipped from the factory, there is a single account name of "admin". Any other accounts required may be created after first logging in with the "admin" account.

There are two types of accounts: administrator and operator. An administrator account has access to all configuration settings and information displays while an operator account has some limitations on what is available to display and change. The type of account is specified when any new account is created.

Only administrators may create new accounts or delete existing accounts.

2.2.1.1 Initial logon

When the local management port is first accessed, enter "admin" as the account name and simply press 'enter' or 'return' when prompted for the password. There initially is no password and a new password must be set before proceeding. The system will automatically prompt for a new password and will not proceed until that is done successfully.

Note: once the password is set, there is no way to subsequently access the management functions without a password. Set the password carefully and do not forget it. It is impossible to recover from a lost password unless there is at least one administrative account available with a known password.

It is suggested that the 'admin' account never be used for day-to-day management of the system and instead be reserved for emergency access in the event other administrative passwords are lost.

2.2.1.2 Account creation

After logging in for the first time, it is suggested that additional accounts be created immediately and that the new accounts be used for normal day-to-day management.

A new account is created using the **`newaccount`** command and specifying an account name and account type. For example, the following command will create a new administrative account with the name "accountname":

```
> newaccount accountname admin
```

See the description of the **`newaccount`** command for more details. Additional account management commands are **`accounts`** to list all accounts, **`delaccount`** for deleting accounts, and **`passwd`** for changing the password on an existing account.

You may wish to log off the "admin" account and use the new account for any additional configuration.

2.2.2 Radio Configuration

A configuration summary with all of the important configuration settings for the radio and the data interface may be displayed with the **`config`** command.

2.2.2.1 Dash Setting

The modems come in two configurations known as "dash one" and "dash two." The "dash one" modems transmit at a lower frequency than they receive while the "dash two" modems are the reverse. One modem of each type is required to form a link.

IMPORTANT: The dash setting corresponds to a physical configuration internal to the modem and should not be changed.

2.2.2.2 Receive Frequency

The receive frequency should be set with the command:

> rxfreq ffff.f

The receive frequency of each modem must equal the transmit frequency of the other modem in the link. The frequency is specified in 0.1 MHz steps.

2.2.2.3 Transmit Frequency

The transmit frequency should be set with the command:

> txfreq ffff.f

The transmit frequency of each modem must equal the receive frequency of the other modem in the link. The frequency is specified in 0.1 MHz steps.

2.2.2.4 Transmit Power

The transmit power should be set with the command:

> txpower nn.n

The transmit power level is specified in dBm, adjustable in 0.5 dB steps.

2.2.2.5 RSL Threshold

The RF Modem has a programmable Receive Signal Level (RSL) threshold detector that may be used to evaluate link margin. When the receive signal level drops below the programmed threshold, the RX alarm will be set. This threshold is set at the factory to a default value of –110 dBm to minimize the chance of inadvertent RSL alarms during initial system setup. The user should set the RSL alarm threshold so that RSL alarm events are generated at an appropriate level depending on the actual operating conditions.

The RSL threshold should be set with the command:

> rslthr –nn.n

The threshold value is specified in dBm.

2.2.2.6 Mute

The modem is configured at the factory with mute on. Mute should not be turned off until the frequency and power settings are set correctly and an appropriate antenna (or load) is attached to the antenna connector.

2.2.3 Data Channel Configuration

2.2.3.1 Channel Selection

The modems may be configured to carry either full-duplex serial or Ethernet traffic. Only one type of traffic can be carried at a time and both ends of the link must be set to the same selection. Configure the channel with the command

> channel serial

or

> channel ethernet

as desired.

2.2.3.2 Serial Port

The DB-25 connector carries the serial data traffic. It may be configured through the software for either synchronous or asynchronous operation at a variety of speeds, and for either EIA-530 or EIA-232 drivers and receivers.

The serial port should be properly configured before connecting to external equipment.

2.2.3.2.1 Speed

Serial data may be either synchronous at 64 or 128 Kbps, or asynchronous at 300 to 19200 bps. The speed selection automatically determines whether the protocol is synchronous or asynchronous.

Both ends of the link must be set to the same speed.

The speed and protocol may be set to 64 or 128 Kbps synchronous with the command:

> speed 64

or

> speed 128

The speed and protocol may be set to 300 to 19200 bps asynchronous with the command:

> speed 300

where the 300 may be replaced with 600, 1200, 2400, 4800, 9600, 14400, or 19200 as desired.

2.2.3.2.2 Clock Source

Synchronous serial mode requires the use of a data clock for both receive data and transmit data. The receive data clock is always derived from the received signal and is provided by the modem. The transmit clock, however, may be provided by one of three sources. With the clock set to internal, the modem supplies a clock at 64 Kbps or 128 Kbps depending on the speed setting. With the clock set to external, the customer equipment supplies a 64 or 128 Kbps clock that should match the speed setting. With the clock set to loop, the receive clock is also used for the transmit side.

The clock mode of the modem at each end of the link must be configured appropriately depending on the clock mode of the customer equipment to which it is attached. For example, if the customer equipment is generating the transmit clock, the modem must use the external clock mode. On the other hand, if the customer equipment is expecting the clock to be provided by the modem, then the modem must be set to internal clock mode. Each end of the link may be configured independently to use internal, external, or looped clock, except that using looped mode at both ends of the link is not recommended.

The clock source may be set with one of the commands:

> clock int

or

> clock ext

or

```
> clock loop
```

2.2.3.2.3 Interface Type

The serial interface may use either EIA-232 or EIA-530 drivers and receivers. Either type of interface may be used with both synchronous and asynchronous data.

Each end of the link may be configured independently.

The interface type may be configured with the command

```
> interface 232
```

or

```
> interface 530
```

2.2.3.3 Data Sharer

The rack-mount unit (4050R) includes a built in data sharer function where two separate EIA-530/232 ports are provided, designated ports A and B.

At any given time one of the ports will be the 'selected' port. The currently selected port depends on the status of the request-to-send (RTS) line on the two ports. If only one port has RTS asserted, that port will be the selected port. If both ports, or neither port, has RTS asserted, then port A is given priority and will be the selected port. The RTS line from either port may be enabled or disabled if desired.

Transmitted data (TD) and the external transmit clock (TSET) used in synchronous mode are always taken from the selected port. The remote and local loopback signals (RL and LL) are also taken from the selected port. Clear-to-send (CTS) will only be asserted on the selected port.

The system may be configured to send receive data to both ports or to the selected port only. The data-set-ready (DSR), receive clock (RSET), and data-carrier-detect (DCD) are always present on both ports.

2.2.3.3.1 RTS Enable

Enable the RTS signal on one or both ports as required. If a port is unused and has no cable connected, it is strongly recommended that the corresponding RTS signal be disabled. The RTS enable may be set with one of the following commands:

```
> rtsenable a
```

or

```
> rtsenable b
```

or

```
> rtsenable both
```

2.2.3.3.2 RX Data Output

Enable sharer data output on both ports or only on the selected port, as desired, with one of the following commands:

```
> sharerout selected
```

or

```
> sharerout both
```

2.2.3.4 Ethernet Data Port

The Ethernet data port requires no configuration. When the Ethernet channel is selected, the link speed is automatically set to 128 Kbps.

The Ethernet data port attempts to transport any valid Ethernet packet it receives to the other end of the link. No assumption is made about higher layer protocols and, in particular, there is not even the assumption that Internet Protocol (IP) is used. The Ethernet data port needs no IP address, netmask, or default gateway.

Since the modem link is slower than the Ethernet network, packets may arrive at the port faster than they can be transmitted across the link. In this case the modem will buffer and transmit as many packets as possible but some packets may be lost. This is consistent with ethernet's "best effort" deliver policy. If guaranteed delivery is required, a higher layer protocol such as Transmission Control Protocol (TCP) will assure delivery even when there is packet loss due to congestion or mis-matched link speeds.

2.2.4 Remote Management Port Configuration

The Ethernet Remote Management System (RMS) port is used for Simple Network Management Protocol (SNMP), software updates, system message logging, and setting the system clock. All of these functions are optional and, if they are unused, the port may be left un-configured and unconnected.

If any of these features are desired, it may be necessary to configure the port before it is connected to the local network. Failure to properly configure the port may cause the port to not operate and/or interfere with the operation of other devices on the local network.

A network configuration summary may be displayed with the **`netconfig`** command.

2.2.4.1 DHCP

The IP parameters of the interface may be automatically configured using a Dynamic Host Configuration Protocol (DHCP) server on the local network. The DHCP server will typically configure the IP address and netmask, default gateway, and Domain Name Servers (DNS).

To enable use of a DHCP server, use the command:

```
> dhcp on
```

To disable the use of a DHCP server, use the command:

```
> dhcp off
```

2.2.4.2 IP Address / Netmask

Each device on the local network requires a unique IP address. If the IP address and netmask are configured with DHCP, the manual IP address and netmask are not used.

To set the IP address, use the command

```
> ip aaa.bbb.ccc.ddd
```

where aaa.bbb.ccc.ddd is the desired IP address in the usual "dotted quad" format.

To set the netmask, use the command

> netmask aaa.bbb.ccc.ddd

where aaa.bbb.ccc.ddd is the desired netmask in the usual “dotted quad” format.

2.2.4.3 Default Gateway

When the local network includes one or more routers connecting to other networks, a default gateway should be specified to indicate which is the most likely router to handle traffic to arbitrary IP addresses.

If DHCP is enabled, this manual setting is not used.

To set the default gateway, use the command

> gateway aaa.bbb.ccc.ddd

where aaa.bbb.ccc.ddd is the IP address of the default router in the usual “dotted quad” format.

2.2.4.4 DNS Servers

If either the timeserver or loghost (see following) are specified by name rather than IP number then a DNS is needed to resolve the name.

If DHCP is enabled, then the DNS may be set automatically. However, if DHCP is disabled or if it does not designate a DNS server, then the manual setting will apply.

Two DNS server may be specified, in which case the secondary server is used in the event the primary server is unavailable.

To set the DNS server use the commands:

> dns pri aaa.bbb.ccc.ddd

> dns sec eee.fff.ggg.hhh

2.2.4.5 Timeserver

The modem does not have real-time clock hardware that will allow it to maintain a time reference when powered off. However, during its startup procedure it will attempt to contact a timeserver on the network to set its clock to the actual time. The time is only used for message logging and other diagnostic purposes and a correct time is merely a convenience. Consequently, the availability of a timeserver is completely optional.

The factory set timeserver is us.pool.ntp.org, which refers to a collection of public timeservers generally available on the Internet. A DNS server must be available to resolve that timeserver name into an IP address.

The protocol used to set the time is NTP (network time protocol). Any NTP server may be used as a timeserver.

To change the timeserver use the command:

> timeserver aaa.bbb.ccc.ddd

or

> timeserver hostname.domainname

where aaa.bbb.ccc.ddd is the IP address of the timeserver in the usual “dotted quad” format, or hostname.domainname is the hostname and domain name. Note that there is no default domain name so it must be explicitly specified with the hostname.

2.2.4.6 Loghost

The modem can send system log messages to a specified loghost. This feature is mainly intended for debugging purposes and a loghost is completely optional. Normally only error messages and a limited number of startup messages are logged.

The “syslog” protocol is used to send the messages. Any host system with a syslog facility may be used to collect the messages. Most Unix and Linux system have syslog capability and there are both free and commercial syslog programs for Windows.

Specifying the loghost with an IP number of 0.0.0.0 or with a name of “none” disables the syslog messages. The system is configured at the factory with the syslog messaging disabled.

To set a loghost use the command

```
> loghost aaa.bbb.ccc.ddd
```

or

```
> loghost hostname.domainname
```

where aaa.bbb.ccc.ddd is the IP address of the loghost in the usual “dotted quad” format, or hostname.domainname is the hostname and domain name of the loghost. Note that there is no default domain name so it must be explicitly specified with the hostname.

2.3 Factory Configuration

The modems are set at the factory to the following standard configuration:

Dash.....as indicated on the label
Mute .....on (no output)
TX Frequency
  -1 .....5096.0 MHz
  -2 .....5145.0 MHz
RX Frequency
  -1 .....5145.0 MHz
  -2 .....5096.0 MHz
Modulation .....on
TX Power .....+14 dBm
Interleave.....0
RSL Threshold .....-110 dBm
Temp Alarm Threshold .....50°C
Channel.....serial
Speed .....64 Kbps synchronous
TX Clock
  -1 .....looped
  -2 .....internal
Interface.....EIA-530
Mode.....point-to-point
Loopback.....off
Administrator account .....admin (no password)
Hostname.....hostname
DHCP .....on
IP 0.0.0.0
Netmask.....255.255.255.0
Gateway.....0.0.0.0
DNS
  primary 0.0.0.0
  secondary 0.0.0.0
Timeserver.....us.pool.ntp.org
Loghost.....0.0.0.0

Modem 4050R only:

Rtsenable .....both
SharerOut.....both

3 Monitoring Operation

3.1 Activity Indicators

When there is serial data present at the EIA-530/232 data port, the TX and RX status LEDs flash to indicate the presence of transmitted and received data respectively.

Each LED flashes when the first data is detected and continues to flash at a predetermined rate as long as data is being detected. In synchronous mode, only changes in the data are detected so that a continuous stream of a single character will not cause the LED to flash.

In addition the DAT status LED flashes to indicate a data error has been detected.

Note: the status LEDs flash to indicate the corresponding activity but will be on solid to indicate an alarm. Refer to the following section for more information on alarms.

3.1.1 Transmit Activity Indicator

The TX status indicator flashes when data input is present at the EIA-530/232 port whether or not this data is transmitted. Certain conditions, such as if loopback is on or the radio is muted, will prevent the data from being transmitted even though the TX indicator is flashing.

3.1.2 Receive Activity Indicator

The RX status indicator flashes when data output is present at the EIA-530/232 port.

3.1.3 Data Error Indicator

The DAT status indicator flashes whenever an uncorrectable error occurs in the received data. This indicates a block of data was corrupted beyond what is correctable by the error correction algorithm. This is not normal and these events should be extremely rare in a normally operating link.

3.2 Alarms

The modem detects various abnormal conditions and generates an alarm to alert operators to the condition. The alarm conditions are grouped in to four categories: system, data, transmit, and receive alarms. Each category is associated with a status LED on the front and rear panels and with a solid-state relay contact closure. The specific conditions that generate each alarm are described below.

The system alarm status LED is green and is normally illuminated. It is extinguished when there is a system alarm or when any of the other alarm categories are asserted. Thus a no-alarm condition is easily identified by the green system LED on the panel being illuminated. Conversely, an alarm condition is easily identified by the green status LED being extinguished.

The other three alarm categories have a corresponding amber status LED that illuminates when an alarm condition is detected. Multiple alarm conditions may be present so more than one alarm LED may be illuminated.

Each of the four alarm categories also has a corresponding solid-state relay contact closure. The system alarm contact closure is normally closed while the other three contact closures are normally open.

The alarm status may be examined with the **`alarm`** command that displays the specific condition generating an alarm, if any. The **`alarm`** command will also indicate the cause of any transient alarm that may have occurred but is now cleared.

3.2.1 System Alarms

High Modem Temperature	The temperature on the modem board exceeds the set high temperature threshold. The factory set threshold is 50°C but may be independently adjusted as desired.
High RF Temperature	The temperature of the RF module exceeds the set high temperature threshold. The factory set threshold is 50°C but may be independently adjusted as desired.
High PA Temperature	The temperature of the transmitter power amplifier exceeds the set high temperature threshold. The factory set threshold is 50°C but may be independently adjusted as desired.

3.2.2 Data Alarms

No Frame Lock	The modem is not able to achieve frame lock on the incoming data. No frame lock may indicate a poor receive signal or mismatched configuration settings between the two ends of the link.

3.2.3 Transmit Alarms

Muted	The transmitter is muted because of a configuration problem or a transmit synthesizer problem.
Synthesizer Out of Lock	The transmit synthesizer is out of lock. This may indicate an unconfigured or misconfigured transmitter, or a hardware failure.
No Transmit Power	No transmit power is detected.
Low Transmit Power	The detected transmit power reading is less than 80% of its nominal value.

3.2.4 Receive Alarms

Synthesizer Out of Lock	The receive synthesizer is out of lock. This may indicate an unconfigured or misconfigured receiver, or a hardware failure.
AGC Out of Lock	The automatic gain control system is not able to achieve a suitable receive signal level.
Low RSL	The receive signal level is below the set threshold level. The RSL is not a measured value but is inferred from the AGC system. The threshold level may be set by the administrator and should be set to an appropriate value depending on the expected operating conditions.

3.3 Status

Useful status information may also be displayed by various commands including **`rsl`**, **`stats`**, **`temp`**, **`linestat`**, and **`ifinfo`**.

The **`rsl`** command continuously displays near real-time receive signal strength and may be used to “peak” the antenna positioning when installing the system.

The **`stats`** command displays statistics about the performance of the Forward Error Correction (FEC) mechanism. This information may be helpful in evaluating the quality of the RF link and the operating margin.

The **`temp`** command displays the current and peak temperatures measured in the RF module, the power amplifier, and the processor/modem.

The **`linestat`** command displays the current status of the modem control signals on the EIA-530/232 data port(s).

The **`ifinfo`** command displays current information about the ethernet ports, including hardware address, IP address, and some performance statistics.

See the description of each command below for details.

4 Local Craft Interface

4.1 Craft Interface Terminal Port

The modem has a Craft Interface Terminal (CIT) port that is used to configure it and monitor its operation. The user interface is a text-based “command line” style so that it is compatible with most laptop Personal Computers (PCs) and Personal Digital Assistants (PDAs). Terminal emulator software such as “HyperTerminal” or equivalent is required for the PC or PDA.

The physical interface is 9600 baud serial with a 9 pin female D-sub connector (DE-9F). The connector is configured as Date Communication Equipment (DCE) so a straight thru cable is used to connect to a typical PC or PDA.

In the following descriptions the authorization designation “RO” indicates the command is “read only” meaning the current value can be displayed but not changed. The designation “RW” indicates the command is “read / write” and the value can be both displayed and changed.

When a command is entered without an optional parameter, the current value is displayed. When the command is entered with a parameter, the value will be changed to the specified value.

In the following usage descriptions, ptional parameters are shown enclosed in square brackets [ ]. Alternative parameters are shown in angle brackets < > and separated by a vertical bar. Unless otherwise noted, only one of the alternatives should be entered. Neither the angle brackets nor the vertical bar should be entered as part of the command.

4.2 Commands

4.2.1 accounts Login Accounts

Usage: accounts

Authorization: Operator RO; Administrator RO

Display a list of existing login account names and the account type.

4.2.2 agc Automatic Gain Control

Usage: agc

Authorization: Operator N/A; Administrator RO

Display the AGC on/off setting.

4.2.3 agcstatus Status

Usage: agcstatus

Authorization: Operator RO; Administrator RO

Display information about the operation of the agc function. Probably only useful to the factory for debugging purposes.

4.2.4 alarms Display Alarms

Usage: alarms

Authorization: Operator RO; Administrator RO

Display alarm conditions, if any. Alarms that have been asserted since the last time this command was issued but are now de-asserted will be marked as "cleared." This feature allows transient alarm condition to be "remembered" and more easily identified.

4.2.5 apc Automatic Power Control

Usage: apc

Authorization: Operator N/A; Administrator RO

Display the APC on/off setting. Note: this setting is normally 'off.'

4.2.6 channel Select Data Channel

Usage: channel [<serial|ethernet>]

Authorization: Operator RW; Administrator RW

With no argument, displays the current data channel. Otherwise sets the data channel to the specified value.

The modem may carry either serial data or 10Base-T Ethernet data. A link speed of 128 Kbps is automatically selected when Ethernet traffic is being carried.

4.2.7 clear Clear Screen

Usage: clear

Authorization: Operator RW; Administrator RW

Clear terminal screen.

4.2.8 clock Clock Mode

Usage: clock [<int|ext|loop>]

Authorization: Operator RW; Administrator RW

Display or set the clock mode.

The clock mode is only applicable to synchronous communications. The synchronous transmit data may be aligned to a clock provided by the modem ("internal" clock), by the Data terminal Equipmemt (DTE) ("external" clock), or by the receiver ("looped-back" clock). The proper choice of clock mode depends on the requirements of the DTE.

With no argument, display the current clock mode. With an argument, set the clock mode to "int," "ext," or "loop."

4.2.9 config Configuration

Usage: config

Authorization: Operator RO; Administrator RO

Show current configuration settings summary.

4.2.10 dash Dash Variation

Usage: dash [<1|2>]

Authorization: Operator RO; Administrator RW

Display or set “dash” variation.

There are two variations for the RF modem: one transmits on a higher frequency and receives on a lower frequency, and the other is the opposite. A link consists of one modem of each variation so that the receive frequency of each one can be tuned to the transmit frequency of the other. These two variations are called “dash one” and “dash two.”

A modem may be physically changed in the field from dash one to dash two, or vice versa, by following a specified procedure. After physically changing the modem, this command must be used to properly configure the software.

Note: this change requires opening the unit and may invalidate the warranty. Please consult the factory before making this change.

With no argument, display the current dash number setting. With an argument of “1” or “2” set the dash number as specified. When the dash number is changed, if there are valid transmit and receive frequencies set, then the frequencies are swapped so that the same frequencies are retained in their correct subbands.

4.2.11 delaccount Delete Login Account

Usage: delaccount name

Authorization: Operator N/A; Administrator RW

Delete the named login account. Deleted accounts can not be undeleted, however they can be recreated although the password will be reset when the account is created.

4.2.12 dhcp DHCP Enable

Usage: dhcp [<0|1>] [<n|y|off|on>]

Authorization: Operator RO; Administrator RW

With no argument displays the current DHCP enable setting. Otherwise sets the DHCP enable to the specified value.

DHCP is a protocol that permits an Ethernet device to have its IP port configuration set automatically. When DHCP is enabled, at startup the modem will request IP configuration information from a DHCP server. If DHCP is

enabled the customer is responsible for providing a DHCP server that will supply the necessary configuration information or the Ethernet port will not work.

If DHCP is disabled, the IP number, netmask, gateway, and DNS configuration must be set manually.

Note: the 0/1 refers to the RMS Ethernet port (0) or the payload Ethernet port (1). Although there is a setting for the payload port, it is not used. The default port is 0, however, so entering a 0 or 1 is unnecessary and is only documented for the sake of completeness.

4.2.13 dhcpinfo DHCP Information

Usage: dhcpinfo

Authorization: Operator RO; Administrator RO

Display ethernet interface information resulting from DHCP configuration. The information includes IP address, network and netmask values, broadcast address, gateway address, domain, domain name server, MAC address, and lease time.

If DHCP is not enabled or was not successful in configuring the interface, a message will be printed indicating no information is available.

4.2.14 dns Domain Name Server

Usage: dns [<pri|sec>] [nnn.nnn.nnn.nnn]

Authorization: Operator RO; Administrator RW

With no argument, displays the IP address of the domain name server(s). Otherwise sets the domain name server address to the specified value.

A domain name server, or DNS, is required for the RMS Ethernet port to locate other networked systems by name. It is possible to set a primary and a secondary name server. If not specified, primary is the default.

If DHCP is enabled, the DNS should be set automatically.

A DNS setting is optional. If it is not needed, an IP number of 0.0.0.0 may be entered.

4.2.15 gateway Network Gateway

Usage: gateway [<nnn.nnn.nnn.nnn|hostname.domain>]

Authorization: Operator RO; Administrator RW

With no argument, displays the default IP gateway. Otherwise sets the default gateway to the specified value.

To communicate beyond the local network, the IP communication must go through an IP router. This command allows a default router to be specified to handle any communication beyond the local network.

The gateway may be specified as a “dotted quad” IP number (nnn.nnn.nnn.nnn) or as a hostname (and domain). If specified as a hostname, a DNS server must be available to resolve the name into an IP number.

4.2.16 help / ? Help

Usage: help [<radio|datalink|network|admin|all>]

Usage: ? [<radio|datalink|network|admin|all>]

Authorization: Operator RO; Administrator RO

Display brief help information about available commands. Help without an argument displays the top level help screen. With an argument, displays help screen for commands related to a specific topic:

radio	radio configuration and performance
datalink	data channel configuration
network	network configuration
admin	administrative commands

4.2.17 hostname Hostname

Usage: hostname [hostname]

Authorization: Operator RO; Administrator RW

With no argument, displays the network hostname for this modem. Otherwise sets the hostname to the specified value.

4.2.18 ident Identify

Usage: ident

Authorization: Operator RO; Administrator RO

Display product identification information.

4.2.19 ifinfo Ethernet Interface Information

Usage: ifinfo [<eth0|eth1>]

Authorization: Operator RO; Administrator RO

Display current ethernet interface information including hardware address (MAC address), IP address if any, status, and statistics.

4.2.20 interface Interface Driver

Usage: interface [<232|530>]

Authorization: Operator RO; Administrator RW

Display or set the interface driver/receiver type.

The interface drivers and receivers may be configured to either EIA-232 (single ended) or EIA-530 (differential) standards. Either style of driver may be used with either the asynchronous or synchronous protocol.

4.2.21 interleave Interleave Data Blocks

Usage: interleave [<0|1|2|3|4|5|6>]

Authorization: Operator RO; Administrator RW

With no argument, displays the current interleave depth. Otherwise set the interleave depth to the specified value.

Data blocks may be interleaved to improve the error performance in the presence of certain kinds of noise and interference. The optimum interleave depends on the characteristics of the noise and interference and is selecting the optimum interleave depth is beyond the scope of this document.

Increasing the interleave depth increases the latency of the link.

Depth of 0 and 1 are equivalent and mean interleaving is off.

4.2.22 ip Internet Protocol Address

Usage: ip [<0|1>] [nnn.nnn.nnn.nnn]

Authorization: Operator RO; Administrator RW

With no argument, display the current manual IP address. Otherwise, set the manual IP address to the specified value.

The IP address is required for the RMS Ethernet port to communicate. If DHCP is disabled then the IP address must be set manually using this command. A unique address must be assigned to each device on the network.

If DHCP is enabled, this setting is ignored. The value reported here DOES NOT represent the IP address established by the DHCP server.

Note: the 0/1 refers to the RMS Ethernet port (0) or the payload Ethernet port (1). Although there is an IP address setting for the payload port, it is not used. The default port is 0, however, so entering a 0 or 1 is unnecessary and is only documented for the sake of completeness.

4.2.23 linestat Display Serial Line Status

Usage: linestat

Authorization: Operator RO; Administrator RO

Display the status of the modem control signals on the EIA-530/232 port(s).

4.2.24 loghost Loghost Address

Usage: loghost [<nn.nn.nn.nn|hostname.domain>]

Authorization: Operator RO; Administrator RW

With no value specified, display the current setting of the loghost. Otherwise set the loghost to the specified value. The loghost may be specified as a “dotted quad” IP address, or as a hostname and domain. The change will take effect when the system is restarted.

Specifying the loghost with an IP number of 0.0.0.0 or with a name of “none” disables the syslog messages. The system is configured at the factory with the syslog messaging disabled

The modem will send system error messages to the specified remote loghost on UDP port 514 using the “syslog” protocol. Use of this feature is completely optional, although it may be useful for monitoring or troubleshooting since a system console is not provided.

Any host system with a syslogd facility may be used to collect the messages. Most Unix and Linux system have syslogd capability and there are both free and commercial syslogd programs for Windows. (See, for example, http://www.kiwisyslog.com.)

4.2.25 loop Loopback Mode

Usage: loop [<0|1|n|y|off|on>]

Authorization: Operator RW; Administrator RW

Display or set the current loopback mode.

With no argument, displays the current loopback setting. With an argument of 0, n, or “off” sets the loopback to off. With an argument of 1, y, or “on” sets the loopback mode to on.

There are three loopback functions: local, remote, and traffic. Local loopback connects the serial data port output (RD) to the serial port input (TD). This is useful for testing the data interface lines, receivers, and drivers.

Remote loopback connects the receive serial data to the transmit serial data. This echos received data back to the sender where it can be checked for correctness, for example with a bit error rate tester (BERT).

4.2.26 mac Media Access Control (MAC) Address

Usage: mac [<0|1>]

Authorization: Operator RO; Administrator RO

Display the Ethernet port MAC address.

Every Ethernet device is required to have a unique MAC or “hardware” address. This address is assigned by the manufacturer and is set at the factory.

The RMS and payload Ethernet ports have separate MAC addresses. The 0 or 1 will select which is displayed. If not specified, the RMS port (0) is displayed.

4.2.27 mod Modulation

Usage: mod [<0|1|n|y|off|on>]

Authorization: Operator RO; Administrator RO

With no argument, displays the current modulation setting. With an argument of 0, n, or “off” sets the modulation to off. With an argument of 1, y, or “on” sets the modulation to on.

4.2.28 multipoint Multipoint Handshaking

Usage: multipoint [<0|1|n|y|off|on>]

Authorization: Operator RW; Administrator RW

With no value specified, display the current multipoint setting. Otherwise, set the multipoint setting to the specified value. Multipoint on indicates point-to-multipoint mode; multipoint off indicates point-to-point mode.

The modems support point-to-point and point-to-multipoint communication modes. In point-to-multipoint mode, only one of the multipoint modems may transmit at any given time. This is controlled by the RTS (request-to-send) control line at the EIA-530/-232 DB-25 port.

When a multipoint modem has permission to transmit, it should assert RTS and wait for the modem to respond by asserting CTS (clear-to-send).

In multipoint mode the RF transmitter will be unmuted when RTS is asserted and, after delay to allow the link to be established, CTS will be asserted to indicate it is okay to send data. The transmitter will be muted when RTS is negated.

Arbitration among the multipoint modems for access to the link is a higher level network function and the responsibility of the customer.

Multipoint mode does not affect the operation of the receiver. The receiver is on whether or not the multipoint modems is transmitting and all multipoint modems may receive simultaneously.

4.2.29 mute Mute the RF output

Usage: mute [<0|1|n|y|off|on>]

Authorization: Operator RO; Administrator RW

Display or set the mute state.

With no argument, displays the current mute setting. With an argument of 0, n, or off sets the mute to “off” (enables RF output). With an argument of 1, y, or on sets the mute to “on” (disables RF output).

4.2.30 netconfig Network Configuration Summary

Usage: netconfig

Authorization: Operator RO; Administrator RO

Display the current network configuration summary.

4.2.31 netflash Update Software via the Network

Usage: netflash [-ift] host filename

or netflash [-if] http://website/filename

Authorization: Operator N/A; Administrator RW

Update the modem and/or application software.

This command will read a new software file via the RMS network connection using HTTP, FTP or TFTP. If the file is successfully downloaded as determined by checksum, the new file will be written to the program FLASH memory and will be run the next time the system is started.

The first form of the command above will use FTP unless the –t option is used, in which case TFTP will be used. The name of the FTP or TFTP server is specified by the 'host' parameter, which may be either an IP number or a host name. If a host name is used the name must be resolvable by DNS.

The second form of the command will use the HTTP protocol. The 'website' may be a web server name (resolvable by DNS) or an IP number.

If updating the modem software, the –f option must be specified. If updating the application and operating system software, do not use the –f option.

The system checks that the file being loaded contains the proper software and that the version is later than the currently installed version. To ignore the version number check, use the –i option, which is primarily useful for reverting to an earlier version of the software.

After loading new software, it is necessary to cycle power to load the new software.

If the software ever fails a consistency check at power up, either because the new software failed to load correctly or because of corruption or hardware failure, the system will automatically revert to a backup copy of software originally loaded at the factory. The backup copy of the software cannot be updated except at the factory.

4.2.32 netmask Network Mask

Usage: netmask [<0|1>] [nnn.nnn.nnn.nnn]

Authorization: Operator RO; Administrator RW

With no value specified, display the current network mask. Otherwise set the network mast to the specified value. The change will take effect when the system is restarted.

The IP address consist of a "network" portion and a "host" portion. The network mask defines how much of the address is used for each one. A typical value for the network mask is 255.255.255.0.

If DHCP is enabled, this setting is ignored. The value reported here DOES NOT represent the network mask established by the DHCP server.

Note: the 0/1 refers to the RMS Ethernet port (0) or the payload Ethernet port (1). Although there is a network mask setting for the payload port, it is not used. The default port is 0, however, so entering a 0 or 1 is unnecessary and is only documented for the sake of completeness.

4.2.33 newaccount Create Login Account

Usage: newaccount name type

Authorization: Operator N/A; Administrator RW

Create the named login account. Account names must begin with a letter, must be no more than 16 characters, and must be unique. Account names are case sensitive. Only the characters A-Z, a-z, 0-9, dash, and underbar are allowed.

4.2.34 passwd Set Passwords

Usage: passwd [account]

Authorization: see below

Change login password. If no account name is specified, change the password for the currently logged in account. If an account is specified, change the password for that account. Only administrators can change the password for another account. Operators can only change their own password.

The new password will be solicited twice and the two entries are required to match in order to catch typing errors.

Passwords are case sensitive. New passwords are subjected to a series of tests designed to reject passwords that are too simple and/or easy to guess. Passwords must have at least characters. Those with two or more numerals, a mixture of uppercase and lowercase letters, and some punctuation are more likely to be accepted.

4.2.35 rsl Received Signal Level

Usage: rsl

Authorization: Operator RO; Administrator RO

Display the current received signal level.. This display is updated continuously until the return/enter key is pressed.

4.2.36 rslthr RSL Alarm Threshold

Usage: rslthr [-nnn.n]

Authorization: Operator RO; Administrator RW

Display or set the received signal level alarm threshold.

If the RSL falls below the specified value, a low received signal alarm is declared.

Without an argument, display the current RSL threshold.

With a numeric argument, sets the RSL alarm threshold to -nnn.n dBm.

4.2.37 rtsenable Data Sharer RTS Enable or Disable

Usage: rtsenable [<both|a|b|none>]

Authorization: Operator RW; Administrator RW

Display or set the enable for the EIA-530/232 data port request-to-send (RTS) inputs. If no data sharer is present, this command is not usable.

With the data sharer, the currently selected port is a function of the RTS signals on the two ports. For a port to contend for access, its RTS signal must be enabled.

Without an argument, display the current RTS enable setting.

With an argument, sets the RTS enables to port a, port b, both ports, or neither port as specified.

4.2.38 rxfreq Receive Frequency

Usage: rxfreq [ffff.f]

Authorization: Operator RO; Administrator RW

Display or set the receive frequency.

With no argument, display the current receive frequency.

With a numeric argument, set the frequency to "ffff.f" MHz. The frequency may be specified in 0.1 MHz (100 KHz) steps. The minimum and maximum frequency depends on the dash variation of the modem:

DASH	MINIMUM	MAXIMUM
-1	5140.0 MHz	5150.0 MHz
-2	5091.0 MHz	5101.0 MHz

4.2.39 sharer Data Sharer Available

Usage: sharer [<yes|no>]

Authorization: Operator RW; Administrator RW

Display or set whether a data sharer is present in the system.

Without an argument, display whether the sharer exists. This is generally determined automatically when the system powers up.

With an argument, override the automatically determined value. This is only intended for testing purposes and not for normal operation. Setting this to 'no' will be persistent and will override the automatic setting. Setting this to yes will only override the automatic setting until the system is power cycled.

The setting should always be set to yes for normal operation.

4.2.40 sharerout Data Sharer Output Selection

Usage: sharerout [<both|selected>]

Authorization: Operator RW; Administrator RW

Display or set how received data is to be output on the EIA-530/232 data sharer ports. Received data may be output on both ports all the time independent of which port is the currently selected port, or may be output only on the currently selected port.

Without an argument, display the current sharer output setting.

With an argument, sets the sharer output to both ports or only the selected port as specified.

4.2.41 speed Set Interface Speed

Usage: speed [<300|600|1200|2400|4800|9600|19200|64|128>]

Authorization: Operator RW; Administrator RW

Display or set the interface speed.

With no argument, display the current interface speed.

With an argument, set the interface speed to the specified value. If the specified speed is “64” or “128” then the speed is set to 64,000 or 128,000 bits per second respectively and the protocol is set to synchronous. If the specified speed is 300 – 19200, the protocol is set to asynchronous.

If the speed is 128 Kbps synchronous, the link speed is also set to 128 Kbps. In all other cases the link speed is set to 64 Kbps.

4.2.42 stats Error Correction Statistics

Usage: stats [<0|clr>]

Authorization: Operator RO; Administrator RW

With no argument, displays the error correction statistics. With an argument of zero or “clr” resets the statistics counters to zero.

The display includes the following information:

Elapsed seconds:	0	Seconds since the counters were last cleared. This time continues to increment whether or not a link is established.
Framing unlocked:	0	Records the number of times the data framing has lost lock. When framing is unlocked, data recovery and error correction are not functional and no useful data is communicated.
Total bytes:	0	Total bytes processed. This counts actual payload data in synchronous serial mode. In asynchronous serial and Ethernet modes this counter include “filler” bytes transmitted when there is no real data.
Corrected bytes:	0	The number of bytes corrected by the error correction logic.

Total blocks:	0	The total number of block processed by the error correction logic. A block contains up to 200 actual data bytes.
Errored blocks:	0	The number of blocks that had a detected error.
Uncorrected blks:	0	The number of blocks that had uncorrectable errors.
Corrected blocks:	0	The number of blocks that had corrected errors.

If there are any corrected blocks, a table is printed indicating how many blocks had one error, how many had two errors, and so forth.

4.2.43 syslog System Logging

Usage: syslog [<none|info|debug>]

Authorization: Operator RO; Administrator RW

With no argument, display the current system logging level. Otherwise, set the specified system logging level.

Multiple arguments may be specified, in which case each argument is applied in the order given. For example,

syslog none debug

will clear all optional logging and then enable logging of debug messages.

The modem sends system messages to a syslog host if one is specified. When a host is specified, the messages are sent using the “syslog” UDP protocol to port 514. Syslog messages are categorized in to multiple levels based on the severity of the condition and the importance of the message. The “info” and “debug” log level messages are optional and are disabled by default. All other messages levels are considered error messages and are always enabled.

The “info” and/or “debug” log levels may be useful for debugging is certain limited circumstances but should otherwise be off.

4.2.44 temp Temperature

Usage: temp

Authorization: Operator RO; Administrator RO

Display the temperature of the modem, the RF module, and the power amplifier.

4.2.45 tempthr Temperature Alarm Thresholds

Usage: tempthr [<rf|pa|modem>] [nn]

Authorization: Operator RO; Administrator RW

If the temperature argument (nn) is absent, display the current temperature alarm thresholds. Otherwise sets the temperature alarm threshold to nn°C.

If one or more of the identifiers “rf”, “pa”, or “modem” is present the command applies only to the specified subsystem(s). If none is specified, the command applies to all subsystems.

An excessive temperature reading in the RF module, the power amplifier, or the modem board will generate a system alarm condition. The factory set threshold for the alarm is 50°C but this may be changed with this command.

4.2.46 testmode Test LEDs, Fans, Relays

Usage: testmode [<0|1|n|y|off|on>]

Authorization: Operator RW; Administrator RW

With no argument, display the current state of the test mode. Otherwise set the test mode on or off as specified.

When the test mode is on, all the front and rear panel status LEDs will be turned on, both fans will be turned on, and the alarm relay states will be inverted.

The operation of the modem will be unaffected. If it is operational it will continue to operate when test mode is on. Note, however, that the inverted state of the alarm relays may externally affect the operation of the modem.

4.2.47 timeserver Time Server

Usage: timeserver [<nn.nn.nn.nn|hostname.domain>]

Authorization: Operator RO; Administrator RW

With no value specified, display the current setting of the time server. Otherwise set the time server to the specified value. The change will take effect when the system is restarted.

The time server may be specified as a “dotted quad” IP address, or as a hostname and domain.

When the system is started, it will attempt to contact the specified time server using Network Time Protocol (NTP) in order to set the modem’s internal time and date. An accurate time and date is optional and not necessary for the modem’s operation but it may be useful for timestamping messages in various system logs.

If the timeserver is not specified, or if the attempt to contact the timeserver is not successful, the modem’s time and date starts at 00:00 on 1-Jan-1970.

4.2.48 txfreq Transmit Frequency

Usage: txfreq [ffff.f]

Authorization: Operator RO; Administrator RW

Display or set the transmit frequency.

With no argument, display the current transmit frequency.

With a numeric argument, set the frequency to “ffff.f” MHz. The frequency may be specified in 0.1 MHz (100 KHz) steps. The minimum and maximum frequency depends on the dash variation of the modem:

DASH	MINIMUM	MAXIMUM
-1	5091.0 MHz	5101.0 MHz
-2	5140.0 MHz	5150.0 MHz

4.2.49 txpower Transmit Power Level

Usage: txpower [nn.n]

Authorization: Operator RO; Administrator RW

Display or set the current transmit power setting.

With no argument, displays the current transmit power setting. With a numeric argument, sets the transmit power level to nn.n. The power level is specified in dBm. Although tenths of a dBm may be specified on the command line, the power level will be set to the next lower 0.5 dBm setting. The power level may be set from a minimum of 0 dBm to a maximum of 30.0 dBm.

4.2.50 uptime System Uptime

Usage: uptime

Authorization: Operator RO; Administrator RO

Display the system “uptime” – the time since the modem was first started. Also displays the modem’s current time (“wall” time) which will only be meaningful if it has been successfully set using a timeserver. See the timeserver command description.

Processor loading information is also shown but it is generally uninteresting.

4.2.51 version Version

Usage: version

Authorization: Operator RO; Administrator RO

Display the version of the software modules in the modem.

5 SNMP - Simple Network Management Protocol

5.1 Overview

The Models 4050 and 4050R include an SNMPv3 agent with the User-based Security Module (USM) using MD5 pass phrases for authentication and DES encryption for privacy. In these systems both authentication and privacy options are permanently enabled and are required. SNMPv1 and SNMPv2 are not supported.

Authentication requires an account name and a pass phrase to gain access. There are no guest or anonymous accounts to permit access without a known account. In addition, the privacy feature requires a separate pass phrase for the encryption. Access is not possible without both the authentication and privacy pass phrases.

The SNMP accounts are separate from and independent of the user accounts used for local management. Creating, changing, or deleting a local user account has no effect on SNMP accounts, and vice versa.

The SNMPv3 implementation implements the view-based access control model (VACM). Each account is assigned a "view" of the MIB structure that defines which objects may be viewed and which may be changed. In the 4050 and 4050R there are two predefined views, once corresponding approximately to the administrator access available at the local management port, and one corresponding approximately to the operator access.

5.2 MIBs

There are three MIBs that are useful when accessing the Models 4050 and 4050R. Two of the these are from Protium Technologies, Inc. and one is from the University of California at Davis (UCD). One of the MIBs from Protium Technologies, Inc. is general information and the other is specific to the Models 4050 and 4050R. The MIB from UCD is used for saving SNMPv3 user account information to non-volatile memory.

The Protium Technologies, Inc. MIBs are printed in the appendices of this document for reference. However, computer files of the MIBs are generally more useful than the printed versions. These may be downloaded from the Protium Technologies, Inc. web site at http://www.protiumtechnologies.com/support/4050.

The MIB files are:

PROTIUMTECH-MIB.mib

PROTIUMTECH-PRODUCTS-MODEL4050-MIB.mib

UCD-SNMP-MIB.txt

5.3 SNMP Tools

There are many SNMP tools ("MIB browsers") available for Windows, Unix, Linux and other operating systems that may be used to access the agent in the modem. Some simple tools are command line based while many have graphical user interfaces, scripting capability, historical databases, and other features. Many are commercial products while others are freely available, or have limited versions that are freely available.
Any recommendation for a specific MIB browser is beyond the scope of this document. However, when selecting a browser be sure that it supports SNMPv3 since this is required. It will also be helpful if the MIB definition files for the 4050/4050R can be imported into the MIB browser.

5.4 Account Management

SNMPv3 user accounts are managed via SNMP itself. They are not accessible from the local management port.

When shipped from the factory, there is a predefined user that may be used for account management and to create additional user accounts. For security, the pass phrase on this predefined user should be changed to prevent

unauthorized access. New user accounts with administrative access may also perform account management, in which case the original factory defined user may be deleted.

The specific details of managing accounts will depend a lot on the particular MIB browser that is being used. The instructions below show command line examples that are probably unlikely to be used in practice. In any case, however, the following steps or their equivalent are necessary for user account management.

5.4.1 Creating a User

The procedure that is used by SNMP to create a new user account is (a) clone an existing user, (b) assign an existing set of access rights to the new user, (c) change the pass phrases of the new user, and (d) commit the changes to non-volatile memory.

5.4.1.1 Cloning a User

New users are created by cloning an existing user. The initial factory provided users ("admin" and "oper") are configured with MD5 authentication and DES privacy encryption. Since cloning is the only way to specify which authentication and privacy protocols to use for a given user, all subsequent users will also have MD5 authentication and DES encryption.

Note: it is only possible to clone to a new user one time. Subsequent attempts to re-clone onto the same user will appear to succeed, but will be silently ignored. This somewhat unexpected behavior is mandated by the SNMPv3 USM specifications (RFC 3414). To recreate a user, it is necessary to first delete the existing user.

The following command clones the existing (factory defined) user "admin" to a new user named "newuser." Each of the options in the command line is explained below.

```
snmpusm –v 3 –u admin –l authPriv –a MD5 –A password –x DES –X password \
      192.168.1.64 create newuser admin
```

The following "common options" in the command line are necessary to access the SNMPv3 agent in the modem for any purpose. Some or all of these may be set as default values in the MIB browser so that it is not necessary to specify them each time.

`–v 3`	Use SNMPv3
`–u admin`	Use user account "admin" to access SNMP
`–l authPriv`	User account "admin" has both authentication and privacy
`–a MD5`	Use MD5 for authentication
`–A password`	Use "password" as the MD5 pass phrase. This is the factory set pass phrase. If the pass phrase has been changes as is recommended, the new pass phrase should be used here.
`–x DES`	Use DES encryption
`–X password`	Use "password" as the DES pass phrase. This is the factory set pass phrase. If the pass phrase has been changes as is recommended, the new pass phrase should be used here. The DES pass phrase may or may not be the same as the MD5 pass phrase.

The following options specify the actual function that is to be performed:

`192.168.1.64`	The IP number (or domain name resolvable to the IP number) of the RF modem. The actual value should refer to the target RF modem.
`create`	The desired USM function, i.e. create a new user

newuser	The name of the new user to create
admin	The name of the existing user from which to clone the new user. Any existing user may be used as the basis for the new user. Note: the new user will initially have the same pass phrases as the existing user.

5.4.1.2 Assigning Access Rights

Although a new user inherits the pass phrases of the cloned-from user, the new user does not inherit any access rights. Unless access rights are explicitly assigned, the new user will have none and will not be able to do anything useful.

The following command assigns the new user "newuser" to an existing group that gives the new user certain access rights. The available group names are "admingroup" and "opergroup" for administrator and operator access respectively.

```
snmpvacm [COMMON OPTIONS] createSec2Group 3 newuser groupname
```

The [COMMON OPTIONS] are those necessary to access SNMPv3 as described above.

The numeral "3" specified the USM security model.

5.4.1.3 Changing the Pass Phrase

When a new user is first created (cloned), the new user has the same pass phrases as the cloned-from user. The pass phrases of the new user should be changed immediately. Note that is necessary to know the existing pass phrase, i.e. the pass phrase of the cloned-from user, in order to change the pass phrase of the new user.

```
snmpusm –v 3 –u newuser –l authPriv –a MD5 –A password –x DES –X password \
      [–Ca][–Cx] passwd OLD–PASSPHRASE NEW–PASSPHRASE
```

This command will change the pass phrase of the user issuing the command. It is issued as the "newuser" using the pass phrase of the cloned-from user ("password"). The "passwd" is the actual command to change the pass phrase, all the parameters prior to that are to authenticate the command.

If the **–Ca** or **–Cx** options are specified, then only the authentication or privacy keys are changed. If these options are not specified, then both the authentication and privacy keys are changed.

5.4.1.4 Committing Changes

After the user is created and access rights are assigned as described above, the user account will be active and may be tested to ensure that everything was specified correctly. However, the user is not automatically saved to non-volatile memory and will disappear if the system is powered off.

It is necessary to explicitly save the changes to non-volatile memory in order for them to remain after the system is powered off. This may be done after the changes are verified to be correct, and perhaps after creating multiple users.

Saving the user tables to non-volatile memory is done by simply writing "1" to a particular OID as in the following example:

```
snmpset [COMMON OPTIONS] .1.3.6.1.4.1.2021.100.13.0 i 1
```

The [COMMON OPTIONS] are those necessary to access SNMPv3 as described above. The letter "i" specifies the following value is an integer.

The numeric OID above corresponds to the following string:

.iso.org.dod.internet.private.enterprises.ucdavis.version.versionSavePersistentData.0

If the UCD MID is loaded into the MIB browser, the above may be accomplished by the simpler:

```
snmpset [COMMON OPTIONS] versionSavePersistentData.0 = 1
```

5.4.2 Changing a User's Pass Phrases

The following command will change the pass phrase of the user issuing the command:

```
snmpusm [COMMON OPTIONS][-Ca][-Cx] \
      passwd OLD-PASSPHRASE NEW-PASSPHRASE
```

The [COMMON OPTIONS] are those necessary to access SNMPv3 as described above.

The "passwd" is the actual command to change the pass phrase. If the -Ca or -Cx options are specified, then only the authentication or privacy keys, respectively, are changed. If these options are not specified, then both the authentication and privacy keys are changed.

Note that the old pass phrase is required in order to set the new pass phrase. This means it is not possible to recover from a lost pass phrase by changing the pass phrase. The only recourse in this case is to delete and recreate the user.

After changing a pass phrase, it is necessary to explicitly save the change to non-volatile memory as described above in the section regarding creating a new user.

5.4.3 Deleting a User

Deleting a user account may be necessary when a user account is no longer needed, or in some cases to re-create the user in order recover a lost password.

Any user with administrator access rights may delete a user account. Users with operator access rights are not permitted to delete users.

```
snmpusm [COMMON OPTIONS] delete username
```

The [COMMON OPTIONS] are those necessary to access SNMPv3 as described above.

6 Specifications

System

Frequency Range	5091 - 5150 MHz
T/R Spacing	54 or 49 MHz
Capacity	64/128 kb/s
Occupied Bandwidth	100/200 kHz
Modulation Type	Modified Duobinary CPM
Forward Error Correction	Reed-Solomon
Interleaving	Selectable 0 - 6
Link Acquisition Time	Less than 5 seconds
Power Supply	Model 4050: 20 to 60 VDC, either polarity Model 4050R: 100-132 VAC, 60 Hz
Power Consumption	<30 Watts
System Gain @10^{-6} BER	128/126 dB
Operating Modes	Full/half Duplex

Transmitter

Transmitter Source	Fully Synthesized
Frequency Tolerance	< 1.5 ppm
Tuning Steps	0.1 MHz
Output Power	30 dBm
Power Adjustment Range	>20 dB, 0.5 dB Steps
Spectral Compliance	NTIA Spectrum Manual, Ch. 5
Tx Mute	<-50 dBm

Receiver

Receiver Source	Fully Synthesized
Frequency Tolerance	< 1.5 ppm
Tuning Steps	0.1 MHz
Rx Threshold @ 10^{-6} BER	-98/-96 dBm
Dynamic Range	> 70 dB
Maximum Input (without damage)	+10 dBm
Residual BER	$<1x10^{-10}$

Interfaces

Data	EIA-530, EIA-232 (DB-25F, DCE) or IEEE 802.3 (RJ-45)
SNMP	IEEE 802.3 (RJ-45)
Local Craft Interface Terminal (CIT)	EIA-232, 9600 bps (DE-9F, DCE)
Alarms	8 pin mini-DIN, 4 form A contact pairs
Antenna	Type N

Unit Management and Diagnostics

Local CIT	Command line interface
SNMP	Version 3

Physical Characteristics

Unit Size	Model 4050: 1.8"H x 9.5"W x 12"D Model 4050R: 1.73”H x 17”W x 13.33”D
Weight	5.0 lb.

Environmental

Temperature Range	0 - 50°C, 0 – 70°C Reduced Tx Power
Humidity	0 - 95% non-condensing
Shock	per IEC-68-2-27
Vibration	per IEC-68-2-6
Safety	Model 4050R: EN60950

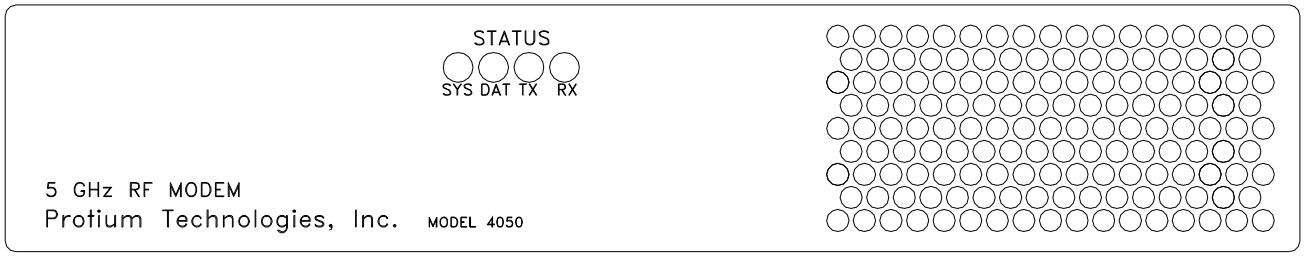
EMC

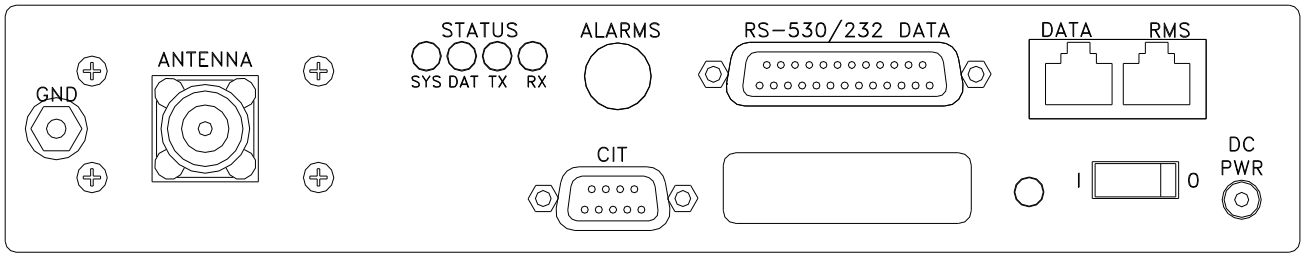
Immunity	per IEC 61000-4-2,3,5,6
Emissions	Compliant with FCC Part 15, Class A Devices

7 Connectors

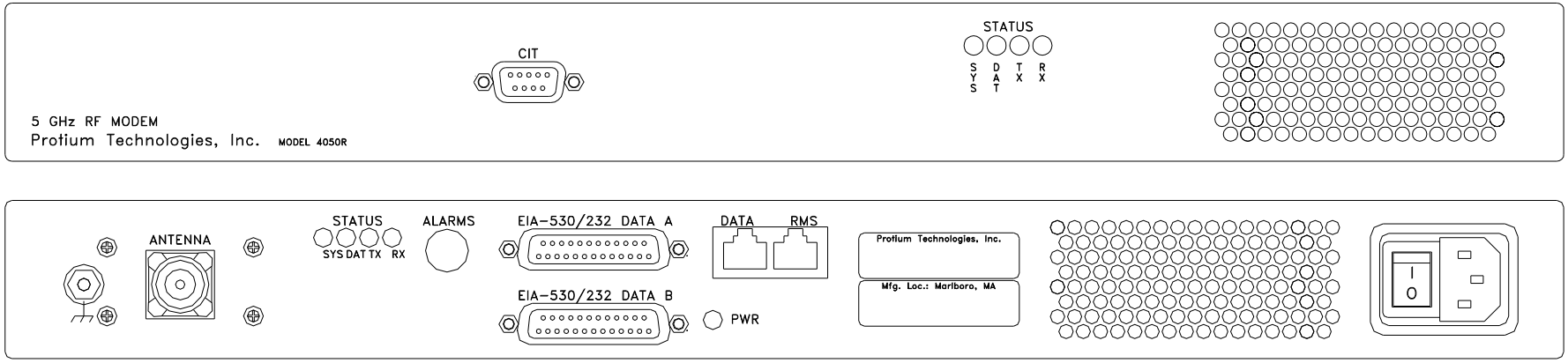
7.1 Front & Rear Panels

7.1.1 Remote Unit





7.1.2 Rack-mount Unit



7.2 Pin-out Tables

7.2.1 Data Port

The following pin-out applies to the data port on a remote unit, and to both ports A and B on the rack-mount unit.

	EIA-232		
PIN	**NAME**	**SOURCE**	**FUNCTION**
1	FG		Chassis Ground
2	TD	DTE	Transmit Data to Modem
3	RD	DCE	Receive Data from Modem
4	RTS	DTE	Request to Send to Modem
5	CTS	DCE	Clear to Send from Modem
6	DSR	DCE	Data Set Ready from Modem
7	SG		Signal Ground
8	DCD	DCE	Receive Line Signal Detect from Modem
9			
10			
11			
12			
13			
14			
15	TC	DCE	Transmit Clock from Modem
16			
17	RC	DCE	Receiver clock from Modem
18	LL	DTE	Local Loopback to Modem
19			
20	DTR	DTE	Data Terminal Ready to Modem
21	RL	DTE	Remote Loopback to Modem
22			
23			
24	TCE	DTE	External Transmit Clock to Modem
25			

	EIA-530			
PIN	**NAME**	**SOURCE**	**FUNCTION**	**Pairing**
1	SHIELD		Shield Ground	
2	TD(A)	DTE	Transmit Data to Modem	14
3	RD(A)	DCE	Receive Data from Modem	16
4	RTS(A)	DTE	Request to Send to Modem	19
5	CTS(A)	DCE	Clear to Send from Modem	13
6	DCR(A)	DCE	DCE Ready from Modem	22
7	SG		Signal Ground	
8	RLSD(A)	DCE	Receive line Signal Detect from Modem	10
9	RSET(B)	DCE	Receive Clock from Modem	17
10	RLSD(B)	DCE	Receive Line Signal Detect from Modem	8
11	TSET(B)	DTE	Terminal Timing Clock to Modem	24
12	TSET(B)	DCE	Transmit Clock from Modem	15
13	CTS(B)	DCE	Clear to Send from Modem	5
14	TD(B)	DTE	Transmit Data to Modem	2
15	TSET(A)	DCE	Transmit Clock from Modem	12
16	RD(B)	DCE	Receive Data from Modem	3
17	RSET(A)	DCE	Receive Clock from Modem	9
18	LL	DTE	Local Loopback to Modem	
19	RTS(B)	DTE	Request to Send to Modem	4
20	DTR(A)	DTE	DTE Ready to Modem	23
21	RL	DTE	Remote Loopback to Modem	
22	DCR(B)	DCE	DCE Ready from Modem	6
23	DTR(B)	DTE	DTE Ready to Modem	20
24	TSET(A)	DTE	Terminal Timing Clock to Modem	11
25	TM	DCE	Test Mode	

NOTE 1: The RF modem is DCE and drives those signals that originate in the DCE

7.2.2 Craft Interface Terminal (CIT) Port

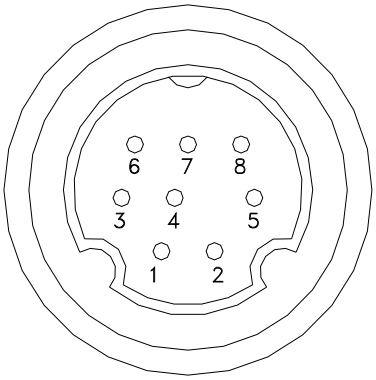
	EIA-232	
PIN	**NAME**	**ORIG**
1	DCD	DCE
2	RD	DCE
3	TD	DTE
4	DTR	DTE
5	SG	
6	DSR	DCE
7	RTS	DTE
8	CTS	DCE
9	RI	DCE

NOTE 1: The RF modem is DCE and drives those signals that originate in the DCE

7.2.3 Alarm Relays

	ALARMS	
PIN	**NAME**	**STATE***
4	SYS1	NC
6	SYS2	
3	DAT1	NO
1	DAT2	
2	TX1	NO
5	TX2	
8	RX1	NO
7	RX2	

*Indicates contact status during normal operation



CONNECTOR MATING END VIEW

NOTE 1: Mating connector is male.

7.2.4 Ethernet

There are two 10Base-T Ethernet ports, one for management and one for carrying data. Both ports will auto-negotiate for either full- or half-duplex.

The connectors are standard RJ-45 and have automatic Media Dependent Interface Crossover (Auto-MDIX) capability for compatibility with MDI and MDIX equipment.

7.2.5 Power

7.2.5.1 Remote Unit

	DC POWER	
PIN	**NAME**	**POLARITY**
Center	V1	+ or -
Sleeve	V2	- or +

NOTE 1: Mating connector is 2.5 mm x 5.5mm x 11mm female

NOTE 2: Both pins are isolated from chassis ground.

NOTE 3: Input voltage 24 to 48 VDC

7.2.5.2 Rack-mount Unit

The AC input connector is a standard IEC-320 C14 appliance inlet that mates to an IEC-320 C13 plug on the AC power cord.

8 Software Licenses

8.1 Open Source Software

The operating system used by the Model 4050 is uClinux 2.4. This is derived from the Linux 2.4 kernel, which is copyrighted by Linus Torvalds and others and licensed under the GNU General Public License (GPL) Version 2.

The C library used in the system is uClibc, which is licensed under the GNU Library General Public License (LGPL) Version 2.

The GNU General Public License and Library General Public License themselves are copyrighted by the Free Software Foundation.

The port of uClinux to the Xilinx Microblaze processor is primarily the work of John Williams, jwilliams@itee.uq.edu.au, and most (if not all) of that work is copyrighted by him. These modifications to the kernel are derivative work and are consequently also licensed under the GNU GPL V2.

Device drivers, which are also generally considered to be part of the kernel, are claimed to be derivative works thereof and, as such, come under the GNU GPL V2 license. This includes the device drivers written or modified by Protium Technologies, Inc. for the Xilinx SPI peripheral and for a specialized character device peripheral. Other device drivers are copyrighted by their respective authors, most notably by John Williams who is responsible for modifying the device drivers for the Microblaze peripherals, by Xilinx, and by others.

Standard Linux application programs provided with the system are copyrighted and licensed individually and separately from the kernel. Each application source directory should be consulted for the copyright and software license terms that apply to that application package.

Copies of the GNU General Public License and the GNU Library General Public License are reproduced in Appendix B for the reader's convenience. These are provided for reference only. The definitive licenses are those that accompany the source code.

Source code is available to legitimate owners of Model 4050 hardware in accordance with the GNU GPL, LGPL, and other applicable licenses. Requests for source code may be sent to Protium Technologies, Inc., 10 Bearfoot Road, Northborough, MA 01532.

8.2 Protium Technologies, Inc. Software License

The various applications embedded in to the equipment that specifically operate and manage the Model 4050, including the command line user interface application, are original works and are Copyright 2005, 2006 by Protium Technologies, Inc. and are licensed in binary form for use only with the Model 4050 RF Modem.

The Protium Technologies, Inc. Software License is located in Appendix B1.

9 Warranty and Service Information

Protium Technologies, Inc.'s standard warranty is one year from the date of delivery, provided that the warranty labels have not been broken. Breaking the seals or opening the modem without the expressed, written consent of Protium Technologies, Inc. will automatically void the warranty.

Protium Technologies, Inc.'s liability for a warranty failure applies only to the equipment provided by Protium Technologies, Inc. and excludes all other remedies, including, without limitation, incidental consequential damages. Protium Technologies, Inc. is not responsible for any lost data, revenue, or any consequential damages associated with a warranty or non-warranty failure.

In the event of a defect in or failure of the Protium Technologies, Inc. product, the customer shall contact Protium Technologies, Inc. regarding the warranty claim. Protium Technologies, Inc. warrants to rework or repair the product at the Protium Technologies, Inc. facility in Northborough, Massachusetts once it has been properly returned by the customer.

To process a warranty claim please contact Protium Technologies, Inc. at the following location:

Protium Technologies, Inc.
10 Bearfoot Road
Northborough, MA 01532
Phone: 508-393-3700
Facsimile: 508-393-3157
warranty@protiumtechnologies.com

Protium Technologies will periodically update the documentation on this product to provide guidance and clarification on common installation issues. Please check the Protium Technologies web site at http://www.protiumtechnologies.com/support/4050 for the latest updates.

Appendix A Protium Technologies, Inc. MIBs

A.1 Protium Technologies, Inc. Enterprise MIB

```
PROTIUMTECH-MIB DEFINITIONS ::= BEGIN

--
-- Top-level infrastructure of the Protium Technologies, Inc. enterprise MIB tree
--
IMPORTS
    MODULE-IDENTITY, enterprises FROM SNMPv2-SMI;

protiumTech MODULE-IDENTITY
    LAST-UPDATED "200701311600Z"
    ORGANIZATION "Protium Technologies, Inc."
    CONTACT-INFO
    "Protium Technologies, Inc.
    10 Bearfoot Road
    Northborough MA 01532
    508-393-3700
    snmp-mib@protiumtechnologies"
    DESCRIPTION
    "Top-level infrastructure of the Protium Technologies, Inc. enterprise MIB tree"
    REVISION     "200701311600Z"
    DESCRIPTION
    "Contact info updated with new address and telephone"
    ::= { enterprises 23271 }
--
--  Net-SNMP enterprise-specific management objects
--
protiumTechRegistrations        OBJECT IDENTIFIER ::= {protiumTech 1}
protiumTechProducts             OBJECT IDENTIFIER ::= {protiumTech 3}
protiumTechNotificationPrefix   OBJECT IDENTIFIER ::= {protiumTech 4}
protiumTechConformance          OBJECT IDENTIFIER ::= {protiumTech 5}
protiumTechExperimental         OBJECT IDENTIFIER ::= {protiumTech 9999}

--
-- A subtree specifically designed for private testing purposes.
-- No "public" management objects should ever be defined within this tree.
--
-- It is provided for private experimentation, prior to transferring a MIB
-- structure to another part of the overall OID tree
--
protiumTechPlaypen              OBJECT IDENTIFIER ::= {protiumTechExperimental 9999}

--
--  Notifications
--
protiumTechNotifications        OBJECT IDENTIFIER ::= {protiumTechNotificationPrefix 0}
protiumTechNotificationObjects  OBJECT IDENTIFIER ::= {protiumTechNotificationPrefix 1}

--
--  Conformance
--     (No laughing at the back!)
--
protiumTechCompliances          OBJECT IDENTIFIER ::= {protiumTechConformance 1}
protiumTechGroups               OBJECT IDENTIFIER ::= {protiumTechConformance 2}

END
```

A.2 Protium Technologies, Inc. Model 4050 MIB

```
PROTIUMTECH-PRODUCTS-MODEL4050-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Integer32 FROM SNMPv2-SMI
    SnmpAdminString                         FROM SNMP-FRAMEWORK-MIB
    protiumTechProducts                     FROM PROTIUMTECH-MIB
--  RowStatus, StorageType                  FROM SNMPv2-TC
--  InetAddressType, InetAddress            FROM INET-ADDRESS-MIB
;

protiumTechModel4050 MODULE-IDENTITY
    LAST-UPDATED "200701311600Z"
    ORGANIZATION "Protium Technologies, Inc."
    CONTACT-INFO
        "Protium Technologies, Inc.
        10 Bearfoot Road
        Northborough MA 01532
        508-393-3700
        snmp-mib@protiumtechnologies"
    DESCRIPTION
        "MIB objects for the agent module of the Model 4050 RF Modem"
    REVISION        "200701311600Z"
    DESCRIPTION     "Revisions for Version 2 Hardware"
    ::= { protiumTechProducts 1 }

--
-- top level structure
--
protiumTechSystem               OBJECT IDENTIFIER ::= { protiumTechModel4050 1 }
    systemInfo                      OBJECT IDENTIFIER ::= { protiumTechSystem 1 }
    systemConfig                    OBJECT IDENTIFIER ::= { protiumTechSystem 2 }
    systemStatus                    OBJECT IDENTIFIER ::= { protiumTechSystem 3 }
    systemStats                     OBJECT IDENTIFIER ::= { protiumTechSystem 4 }
protiumTechAlarms               OBJECT IDENTIFIER ::= { protiumTechModel4050 2 }
    alarmInfo                       OBJECT IDENTIFIER ::= { protiumTechAlarms 1 }
    alarmConfig                     OBJECT IDENTIFIER ::= { protiumTechAlarms 2 }
    alarmStatus                     OBJECT IDENTIFIER ::= { protiumTechAlarms 3 }
    alarmStats                      OBJECT IDENTIFIER ::= { protiumTechAlarms 4 }
protiumTechRadio                OBJECT IDENTIFIER ::= { protiumTechModel4050 3 }
    radioInfo                       OBJECT IDENTIFIER ::= { protiumTechRadio 1 }
    radioConfig                     OBJECT IDENTIFIER ::= { protiumTechRadio 2 }
    radioStatus                     OBJECT IDENTIFIER ::= { protiumTechRadio 3 }
    radioStats                      OBJECT IDENTIFIER ::= { protiumTechRadio 4 }
    radioCalibration                OBJECT IDENTIFIER ::= { protiumTechRadio 5 }
protiumTechModem                OBJECT IDENTIFIER ::= { protiumTechModel4050 4 }
    modemInfo                       OBJECT IDENTIFIER ::= { protiumTechModem 1 }
    modemConfig                     OBJECT IDENTIFIER ::= { protiumTechModem 2 }
    modemStatus                     OBJECT IDENTIFIER ::= { protiumTechModem 3 }
    modemStats                      OBJECT IDENTIFIER ::= { protiumTechModem 4 }
protiumTechInterfaces           OBJECT IDENTIFIER ::= { protiumTechModel4050 5 }
    interfacesInfo                  OBJECT IDENTIFIER ::= { protiumTechInterfaces 1 }
    interfacesConfig                OBJECT IDENTIFIER ::= { protiumTechInterfaces 2 }
    interfacesStatus                OBJECT IDENTIFIER ::= { protiumTechInterfaces 3 }
    interfacesStats                 OBJECT IDENTIFIER ::= { protiumTechInterfaces 4 }
protiumTechManagement           OBJECT IDENTIFIER ::= { protiumTechModel4050 6 }
protiumTechPersistantConfig     OBJECT IDENTIFIER ::= { protiumTechModel4050 7 }
protiumTechTestModes            OBJECT IDENTIFIER ::= { protiumTechModel4050 8 }
```

```
--
-- system objects
--

productIdentity OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Identification of the Protium Technologies product."
    ::= { systemInfo 1 }

productModelNumber OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..12))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Model number of the Protium Technologies product."
    ::= { systemInfo 2 }

productDescription OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Description of the Protium Technologies product."
    ::= { systemInfo 3 }

productManufacturer OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Manufacturer of the Protium Technologies product."
    ::= { systemInfo 4 }

serialNumber OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..12))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Serial number of this particular system."
    ::= { systemInfo 5 }

embeddedSoftwareVersion OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..24))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Version number of the embedded software. The format is flexible but
        is generally of the form <major>.<minor>.<revision> where major, minor,
        and revision are numeric fields. The major version identifies significant
        changes if capabiltiy or functionality. The minor version indicates
        a less significant change in functionality. The revision generally
        indicates a fix or improvement to existing functionality."
    ::= { systemInfo 6 }

modemSoftwareVersion OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..24))
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Version number of the embedded software. The format is flexible but
        is generally of the form <major>.<minor>.<revision> where major, minor,
        and revision are numeric fields. The major version identifies significant
        changes if capabiltiy or functionality. The minor version indicates
        a less significant change in functionality. The revision generally
        indicates a fix or improvement to existing functionality."
    ::= { systemInfo 7 }

radioSoftwareVersion OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..24))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Version number of the embedded software. The format is flexible but
        is generally of the form <major>.<minor>.<revision> where major, minor,
        and revision are numeric fields. The major version identifies significant
        changes if capabiltiy or functionality. The minor version indicates
        a less significant change in functionality. The revision generally
        indicates a fix or improvement to existing functionality."
    ::= { systemInfo 8 }

panelLEDS OBJECT-TYPE
    SYNTAX      BITS { sysLED(0), dataLED(1), txLED(2), rxLED(3) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Status of the front and real panel LED indicators. The system LED
        is normally on; the other LEDs are normally off."
    ::= { systemStatus 1 }

relayContacts OBJECT-TYPE
    SYNTAX      BITS { sysRelay(0), dataRelay(1), txRelay(2), rxRelay(3) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Status of the relay contacts. The system contact is
        normally closed (1); the other contacts are normally open."
    ::= { systemStatus 2 }

coolingFans OBJECT-TYPE
    SYNTAX      BITS { fan1(0), fan2(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Status of the cooling fans. The numbers of fans in operation
        is temperature dependent."
    ::= { systemStatus 3 }

currentAlarms OBJECT-TYPE
    SYNTAX      BITS {  summary(0), modemTemp(1), rfTemp(2), paTemp(3),
                        linkDown(4),
                        txSynthOOL(5), txMuted(6), txNoPower(7),    txLowPower(8),
                        rxSynthOOL(9), rxAgcOOL(10), rxLowRsl(11) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "A collection of status bits indicating alarm conditions. The alarms are:
        summary      inclusive OR of all the other alarms
```

```
        modemTemp    the modem temperature exceeds the alarm threshold
        rfTemp       the RF module temperature exceeds the alarm threshold
        paTemp       the PA module temperature exceeds the alarm threshold
        linkdown     there is no frame lock on the receiver
        txSynthOOL   the TX frequency synthesizer is out of lock
        txMuted      the transmitter is muted
        txNoPower    no power is detected at the transmitter
        txLowPower   the transmitter power out is abnormally low
        rxSynthOOL   the RX frequency synthesizer is out of lock
        rxAgcOOL     the receiver automatic gain control has excessive error
        rxLowRsl     the receiver signal level is below the alarm threshold"
    ::= { alarmStatus 1 }

--
-- radio objects
--
radioMuteSetting OBJECT-TYPE
    SYNTAX      INTEGER { mute(0), unmute(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Desired unmute setting."
    ::= { radioConfig 1 }

radioDashVariation OBJECT-TYPE
    SYNTAX      INTEGER { undefined(0), txlow(1), txhigh(2) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Value of 1 indicates radio transmits in the low subband and
        receives in the high subband. A value of 2 indicates the radio
        transmits in the high subband and receives in the low subband.
        A value of zero indicates the radio has not been configured. An
        unconfigured radio will not transmit at all."
    ::= { radioConfig 2 }

radioTxFrequencySetting OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "KHz"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Transmit frequency in KHz."
    ::= { radioConfig 3 }

radioRxFrequencySetting OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "KHz"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Receiver frequency in KHz."
    ::= { radioConfig 4 }

radioTxPowerSetting OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "cBm"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Transmit output power in cBm (centibels referred to 1 mW)."
```

```
    ::= { radioConfig 5 }

radioRslAlarmThreshold OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "cBm"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Low received signal alarm threshold in cBm (centibels referred to 1 mW)."
    ::= { radioConfig 6 }

radioTempAlarmThreshold OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "High temperature alarm threshold of the radio module in degrees C."
    ::= { radioConfig 7 }

powerAmpTempAlarmThreshold  OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "High temperature alarm threshold of the power amplifier in degrees C."
    ::= { radioConfig 8 }

muteState   OBJECT-TYPE
    SYNTAX      INTEGER { unmuted(0), mutedByOper(1), mutedByConfigErr(2),
                          mutedBySynthUnlocked(3), mutedForReconfig(4),
                          mutedByRTS(5) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Actual mute state. The value is 1 if the radio is muted by operator
        command; the value is 2 if the operator has attempted to unmute the
        radio but it is prevented by mis-configuration (probably illegal TX
        frequency); the value is 3 if the frequency is okay but the synthesizer
        is out of lock; the value is 4 if the radio is temporarily muted while
        it is being reconfigured; the value is 5 if configured for multi-point
        and the request-to-send (RTS) line on the serial port is negated."
    ::= { radioStatus 1 }

txSynthLocked   OBJECT-TYPE
    SYNTAX      INTEGER { unlocked(0), locked(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Transmit synthesizer lock state"
    ::= { radioStatus 2 }

rxSynthLocked   OBJECT-TYPE
    SYNTAX      INTEGER { unlocked(0), locked(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Receive synthesizer lock state"
    ::= { radioStatus 3 }
```

```
receivedSignalLevel OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "cBm"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Receive signal level in centibels referred to 1 mW."
    ::= { radioStatus 4 }

txAttenuationSetting    OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Transmitter attenuation setting."
    ::= { radioStatus 5 }

txDeviationSetting  OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Transmitter deviation setting."
    ::= { radioStatus 6 }

radioTemperature    OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Temperature of the radio module in degrees C."
    ::= { radioStatus 7 }

powerAmpTemperature OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Temperature of the power amplifier in degrees C."
    ::= { radioStatus 8 }

peakRadioTemperaure OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Peak temperature of the radio module in degrees C."
    ::= { radioStats 7 }

peakPowerAmpTemperature OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Peak temperature of the power amplifier in degrees C."
    ::= { radioStats 8 }
```

```
deviation64K    OBJECT-TYPE
    SYNTAX      Unsigned32(0..1023)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Deviation calibration setting for 64K link speed."
    ::= { radioCalibration 1 }

deviation128K   OBJECT-TYPE
    SYNTAX      Unsigned32(0..1023)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Deviation calibration setting for 128K link speed."
    ::= { radioCalibration 2 }

tcxoCalSetting  OBJECT-TYPE
    SYNTAX      Unsigned32(0..1023)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "TCXO calibration setting."
    ::= { radioCalibration 3 }

txAttenOffset   OBJECT-TYPE
    SYNTAX      Integer32(-32..31)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Transmit power calibration setting."
    ::= { radioCalibration 4 }

rslCalOffset    OBJECT-TYPE
    SYNTAX      Integer32(-32..31)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Inferred receive signal level calibration setting."
    ::= { radioCalibration 5 }

--
-- protiumTechModem objects
--

interleave  OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Interleave factor: 0 through 6. Both 0 and 1 are no interleave"
    ::= { modemConfig 1 }

clearRsStats    OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Clears Reed-Soloman statistics counters when read. Always reads 0."
    ::= { modemConfig 2 }

modemTempAlarmThreshold OBJECT-TYPE
```

```
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "High temperature alarm threshold of the modem module in degrees C."
    ::= { modemConfig 3 }

frameLocked OBJECT-TYPE
    SYNTAX      INTEGER { unlocked(0), locked(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Receive frame lock state"
    ::= { modemStatus 1 }

modemTemperature    OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Temperature of the modem board in degrees C."
    ::= { modemStatus 3 }

peakModemTemperature    OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "degrees C"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Peak temperature of the modem board in degrees C."
    ::= { modemStatus 4 }

totalKBytes OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "KBytes"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of kilobytes processed by the R-S decoder
        (using the computer science definition of 1024 bytes
        per kilobyte)."
    ::= { modemStats 1 }

correctedBytes  OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "bytes"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of bytes corrected by the R-S decoder."
    ::= { modemStats 2 }

totalBlocks OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder."
    ::= { modemStats 3 }
```

```
erroredBlocks   OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that had errors."
    ::= { modemStats 4 }

uncorrectedBlocks   OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that had uncorrectable errors."
    ::= { modemStats 5 }

correctedBlocks OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that had corrected errors."
    ::= { modemStats 6 }

errorHistogram  OBJECT IDENTIFIER ::= { modemStats 7 }

blocksWith1Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 1 corrected error byte."
    ::= { errorHistogram 1 }

blocksWith2Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 2 corrected error bytes."
    ::= { errorHistogram 2 }

blocksWith3Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 3 corrected error bytes."
    ::= { errorHistogram 3 }

blocksWith4Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 4 corrected error bytes."
```

```
    ::= { errorHistogram 4 }

blocksWith5Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 5 corrected error bytes."
    ::= { errorHistogram 5 }

blocksWith6Errs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Number of blocks processed by the R-S decoder that
        had 6 corrected error bytes."
    ::= { errorHistogram 6 }


--
-- interfacesInfo objects
--

dataSharerExists    OBJECT-TYPE
    SYNTAX      INTEGER { no(0), yes(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Whether a data sharer (port B) exists."
    ::= { interfacesInfo 1 }

--
-- interfacesConfig objects
--

baudrate    OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Asynchronous: 300 | 600 | 1200 | 2400 | 4800 | 9600 | 14400 | 19200
        Synchronous: 64 | 128"
    ::= { interfacesConfig 1 }

serialMode  OBJECT-TYPE
    SYNTAX      INTEGER { synchronous(0), asynchronous(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Serial port protocol. This is read-only because it is set
        implicitly by the baudrate"
    ::= { interfacesConfig 2 }

interfaceType   OBJECT-TYPE
    SYNTAX      INTEGER { eia530(0), eia232(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Interface driver type"
```

```
    ::= { interfacesConfig 3 }

clockSource OBJECT-TYPE
    SYNTAX      INTEGER { internal(0), external(1), looped(2) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Synchronous serial clock source"
    ::= { interfacesConfig 4 }

sharerOutputGated   OBJECT-TYPE
    SYNTAX      INTEGER { notGated(0), gated(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Data sharer received data output selection. If not gated, received
        data is output on both ports. If gated, received data is only output
        on the currently active port."
    ::= { interfacesConfig 5 }

sharerRtsEnables    OBJECT-TYPE
--    SYNTAX      BITS { portA(0), portB(1) }
    SYNTAX      INTEGER { neither(0), portA(1), portB(2), both(3) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Data sharer transmit data input selection. Access is governed by
        the RTS signals. If only one port has RTS asserted, that port will
        be granted access. If both ports have RTS asserted, port A has
        priority and will get access. If neither port has RTS asserted,
        port A will get access by default."
    ::= { interfacesConfig 6 }

--
-- interfacesStatus objects
--
selectedSerialPort  OBJECT-TYPE
    SYNTAX      INTEGER { PortA(0), PortB(1) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Which data sharer is currently selected."
    ::= { interfacesStatus 1 }

statusSerialPortA OBJECT-TYPE
    SYNTAX      BITS {  RTS(0), CTS(1), DTR(2), DSR(3),
                        RLSD(4), LL(5), RL(6), TM(7) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current status of the modem control lines:
        RTS     Request To Send
        CTS     Clear To Send
        DTR     Data Terminal Ready
        DSR     Data Set Ready
        RLSD    Receive Line Signal Detected
        LL      Local Loopback
        RL      Remote Loopback
        TM      Test Mode"
    ::= { interfacesStatus 2 }
```

```
statusSerialPortB OBJECT-TYPE
    SYNTAX      BITS {  RTS(0), CTS(1), DTR(2), DSR(3),
                        RLSD(4), LL(5), RL(6), TM(7) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current status of the modem control lines:
        RTS     Request To Send
        CTS     Clear To Send
        DTR     Data Terminal Ready
        DSR     Data Set Ready
        RLSD    Receive Line Signal Detected
        LL      Local Loopback
        RL      Remote Loopback
        TM      Test Mode"
    ::= { interfacesStatus 3 }

--
-- protiumTechPersistantConfig objects
--

hostname OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..32))
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "hostname of the processor"
    ::= { protiumTechPersistantConfig 1 }

dnsServer1 OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of our primary DNS server"
    ::= { protiumTechPersistantConfig 2 }

dnsServer2 OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of our secondary DNS server"
    ::= { protiumTechPersistantConfig 3 }

defaultGateway OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of our default gateway"
    ::= { protiumTechPersistantConfig 4 }

timeserver OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..64))
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "host name (or IP number) of an ntp timeserver"
    ::= { protiumTechPersistantConfig 5 }
```

```
mgmtPortDhcpEnable OBJECT-TYPE
    SYNTAX      INTEGER { disabled(0), enabled(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "If enabled, use DHCP to configure the management ethernet port"
    ::= { protiumTechPersistantConfig 6 }

mgmtPortIPV4Address OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of management ethernet port if manually configured"
    ::= { protiumTechPersistantConfig 7 }

mgmtPortNetmask OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of netmask for management ethernet port if manually configured"
    ::= { protiumTechPersistantConfig 8 }

mgmtPortHardwareAddress OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(18))
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Hardware MAC address for management ethernet port"
    ::= { protiumTechPersistantConfig 9 }

dataPortDhcpEnable OBJECT-TYPE
    SYNTAX      INTEGER { disabled(0), enabled(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "If enabled, use DHCP to configure the management ethernet port"
    ::= { protiumTechPersistantConfig 10 }

dataPortIPV4Address OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of payload ethernet port if manually configured"
    ::= { protiumTechPersistantConfig 11 }

dataPortNetmask OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "dotted quad of netmask for payload ethernet port if manually configured"
    ::= { protiumTechPersistantConfig 12 }

dataPortHardwareAddress OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(18))
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
```

```
        "Hardware MAC address for payload ethernet port"
    ::= { protiumTechPersistantConfig 13 }

--
-- testModes objects
--

panelLedTM  OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), on(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Test all panel LEDs. All Leds are forced on."
    ::= { protiumTechTestModes 1 }

alarmRelayTM    OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), on(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Test all alarm relays. Alarm relay states are inverted."
    ::= { protiumTechTestModes 2 }

coolingFansTM   OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), on(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Test both cooling fans. Both fans are forced on."
    ::= { protiumTechTestModes 3 }

loopbackTM  OBJECT-TYPE
    SYNTAX      INTEGER { off(0), local(1), remote(2), locrem(3), traffic(4) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Local loopback loops the interface receivers to the
        drivers. No modem functions are exercised.
        Remote loopback loops the received bit stream back to
        the transmitter. Symbol decoding and encoding are
        exercised; Interleaving and error correction are not.
        Traffic loopback loops the local interface input to
        the local output. Serialization, deserialization,
        framing, interleaving, and error correction are all
        exercised; symbol encoding and decoding are not."
    ::= { protiumTechTestModes 4 }

rfLoopbackTM    OBJECT-TYPE
    SYNTAX      INTEGER { off(0), on(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Attempt RF loopback. Sets the receiver to the same
        frequency as the transmitter and set the transmitter
        to minimum power (maximum attenuation). Leakage may
        allow the radio to receive its own signal. Maybe."
    ::= { protiumTechTestModes 5 }

modulationTM    OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), off(1) }
    MAX-ACCESS  read-write
```

```
    STATUS      current
    DESCRIPTION
        "Disable modulation and output a CW carrier."
    ::= { protiumTechTestModes 6 }

disableAgcTM    OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), disabled(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Disable receiver automatic gain control."
    ::= { protiumTechTestModes 7 }

disableApcTM    OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), disabled(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Disable the transmitter temperature compensated
        power control."
    ::= { protiumTechTestModes 8 }

disableRfModuleTM   OBJECT-TYPE
    SYNTAX      INTEGER { normal(0), disabled(1) }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Communication with the RF module is disabled. The SPI bus
        to the PIC processor will not be used. The RF module remains
        in its current state."
    ::= { protiumTechTestModes 9 }

END
```

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Appendix C GLOSSARY

BERT Bit-Error Rate Test. A test to determine the BER.

BER Bit-Error Rate. The ratio of the number of incorrect bits received to the total number of bits received. The bit-error rate is usually expressed in scientific notation such as 1.0×10^{-6} or 1.0E-6.

Bit Binary "digit." A bi-valued entity representing the smallest unit of information and generally represented by zero ("0") or one ("1").

bps Bits Per Second.

byte Eight bits.

dB Decibel. The ratio of two power levels expressed as ten times the base 10 logarithm of the ratio.

dBm An absolute power measurement expressed as decibels relative to one milliwatt.

CIT Craft Interface Terminal. A generic text-based terminal with an EIA-232 serial interface used for local management functions. This may be a dedicated text terminal, a personal computer with terminal emulator software, or a Personal Digital Assistant (PDA) with serial port and terminal emulator software.

DCE Data Communications Equipment. The communication equipment, such as a modem, involved in a communication channel. Contrast with DTE.

DNS Domain Name Server. A network server that provides a service to map network domain names to IP network addresses.

DHCP Dynamic Host Configuration Protocol. A network protocol used to automatically (and dynamically) configure an IP network port.

DTE Date Terminal Equipment. The end node equipment involved in a communication channel. The DTE is the source and/or destination for the information sent over the communication channel. Contrast with DCE.

EIA Electronic Industries Alliance.

FCC Federal Communications Commission.

FEC Forward Error Correction. A means by which errors that corrupt a message sent through a communication channel may be corrected. In FEC, redundant information is added to the message at the sender and processed at the receiver so that the original message may be recovered intact in spite of certain errors.

GHz Gigahertz. A frequency of 1,000,000,000 cycles per second.

GPL GNU General Public License. A license agreement for open-source software (copyrighted by the Free Software Foundation).

IP Internet Protocol.

Kbps Kilobits per second.

LGPL GNU Library General Public License. A license agreement for open-source software (copyrighted by the Free Software Foundation). The LGPL is typically used for libraries and other software "building blocks."

MDIX Media Dependent Interface - Crossover. An Ethernet port connection using twisted pair cabling where a null-modem (or crossover) function is inherent in the pin assignments in the connector.

MIB Management Information Base. The database of values, parameters, and events managed by SNMP for an entity (device).

MHz Megahertz. A frequency of 1,000,000 cycles per second.

NTP Network Time Protocol. An network protocol that allows real-time clocks to be synchronized via the network. Often used to synchronize local clocks to a standard reference.

RMS Remote Management System. A generic reference to software used to manage (configure, monitor, and troubleshoot) the equipment remotely via a network connection.

RO Read Only. A read-only value may be displayed but not changed.

RF Radio Frequency.

RSL Received Signal Level. The received signal power usually expressed in dBm.

RW Read-Write. A read-write value may be displayed and changed.

SNMP Simple Network Management Protocol. A common protocol for managing devices via a network that is anything but simple.

SNR Signal-to-Noise Ratio, expressed in dB.

TCP Transmission Control Protocol. TCP is a layered protocol based on the Internet Protocol as its underlying protocol. TCP is connection and stream oriented. It provides for reliable communication over packet-switched networks by using flow control, packet retransmission, and other techniques.